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(54) **ROBOT**

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(73) Assignee: **Seiko Epson Corporation** (JP)

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B25J 9/00 (2006.01)

(52) **U.S. Cl.**
CPC ***B25J 19/0062*** (2013.01); ***B25J 9/0018*** (2013.01)

(58) **Field of Classification Search**
CPC B25J 19/0062; B25J 9/0018; B25J 18/04
USPC 74/490.01–490.06
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,781,103 A * 11/1988 Maruyama B25J 9/148 414/730
5,107,754 A * 4/1992 Nishikawa B25J 9/06 60/484
5,138,904 A * 8/1992 Lande B05B 13/0431 74/661
5,220,849 A * 6/1993 Lande B05B 13/005 74/479.01
5,261,316 A * 11/1993 Nishikawa B25J 9/06 91/422
5,293,107 A * 3/1994 Akeel B25J 9/08 310/83
8,156,840 B2 * 4/2012 Tange B25J 9/102 74/490.01
8,171,822 B2 * 5/2012 Yamamoto F16H 57/04 184/109
8,783,848 B2 * 7/2014 Yokozawa B41J 3/28 347/102
8,801,125 B2 * 8/2014 Akiyama B41J 2/2114 347/101
2005/0133305 A1 * 6/2005 Okada B25J 19/0062 184/65
2008/0287243 A1 * 11/2008 Yamamoto F16H 57/04 475/159
2009/0169343 A1 * 7/2009 Tange B25J 9/102 414/217
2012/0229535 A1 * 9/2012 Akiyama B41J 2/2114 347/5

(Continued)

FOREIGN PATENT DOCUMENTS

JP 11-254377 A 9/1999

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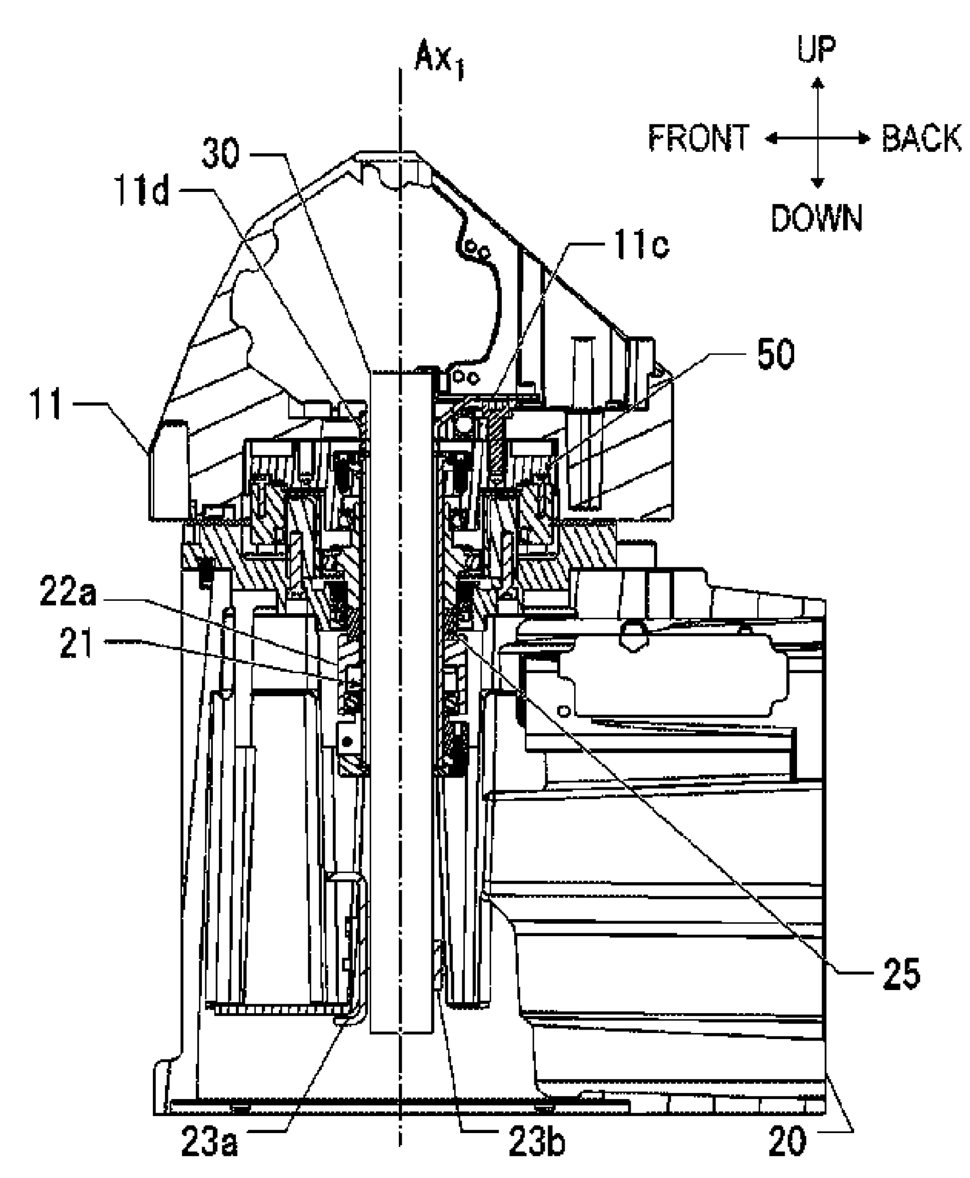
(57) **ABSTRACT**

A robot includes a base, an arm provided on the base, and a reducer having a sliding part and decelerating driving of the arm, wherein a lubricating oil can be supplied to the sliding part from an opposite side to the arm with respect to the sliding part.

10 Claims, 8 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2013/0260606	A1*	10/2013	Hahakura	H01R 13/60 439/534
2014/0320562	A1*	10/2014	Akiyama	B41J 2/2114 347/16

* cited by examiner

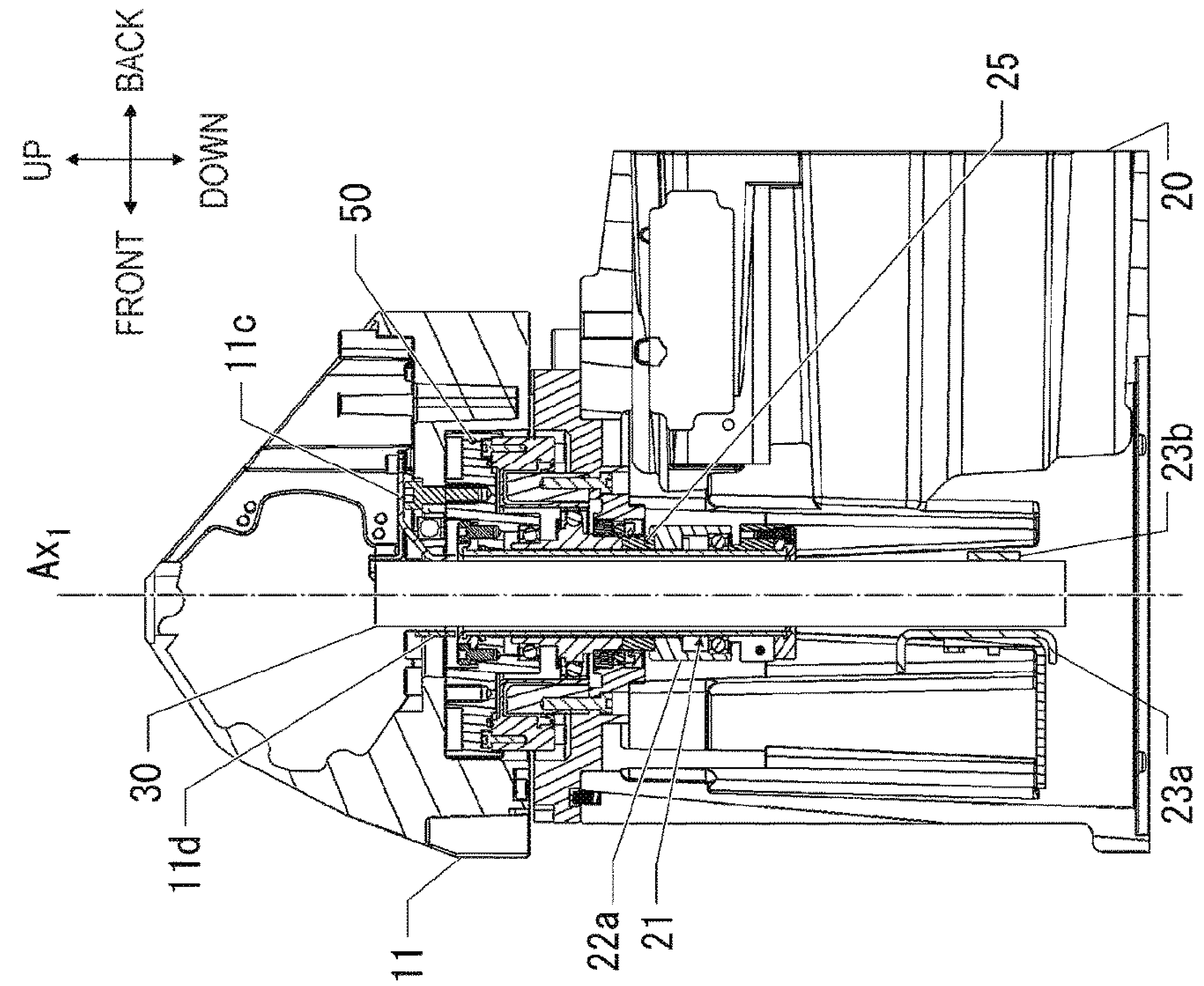

UP
BACK
FRONT
DOWN
50
25
20
11c
Ax_1
23b
30
11d
11
22a
21
23a

FIG. 1B

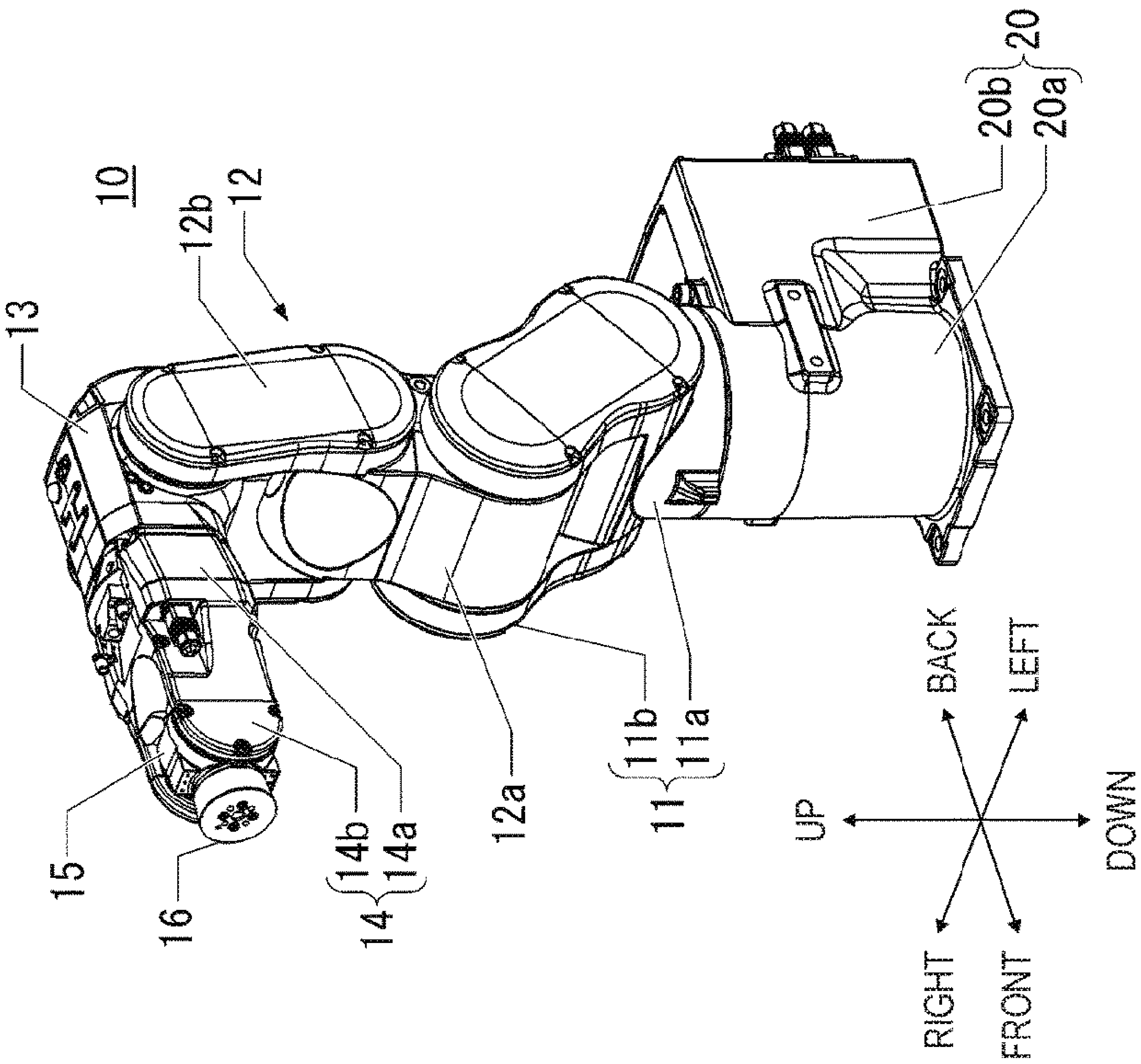

10
12
12b
13
20
20b
20a
15
16
14
14b
14a
12a
11
11b
11a
BACK
LEFT
UP
DOWN
RIGHT
FRONT

FIG. 1A

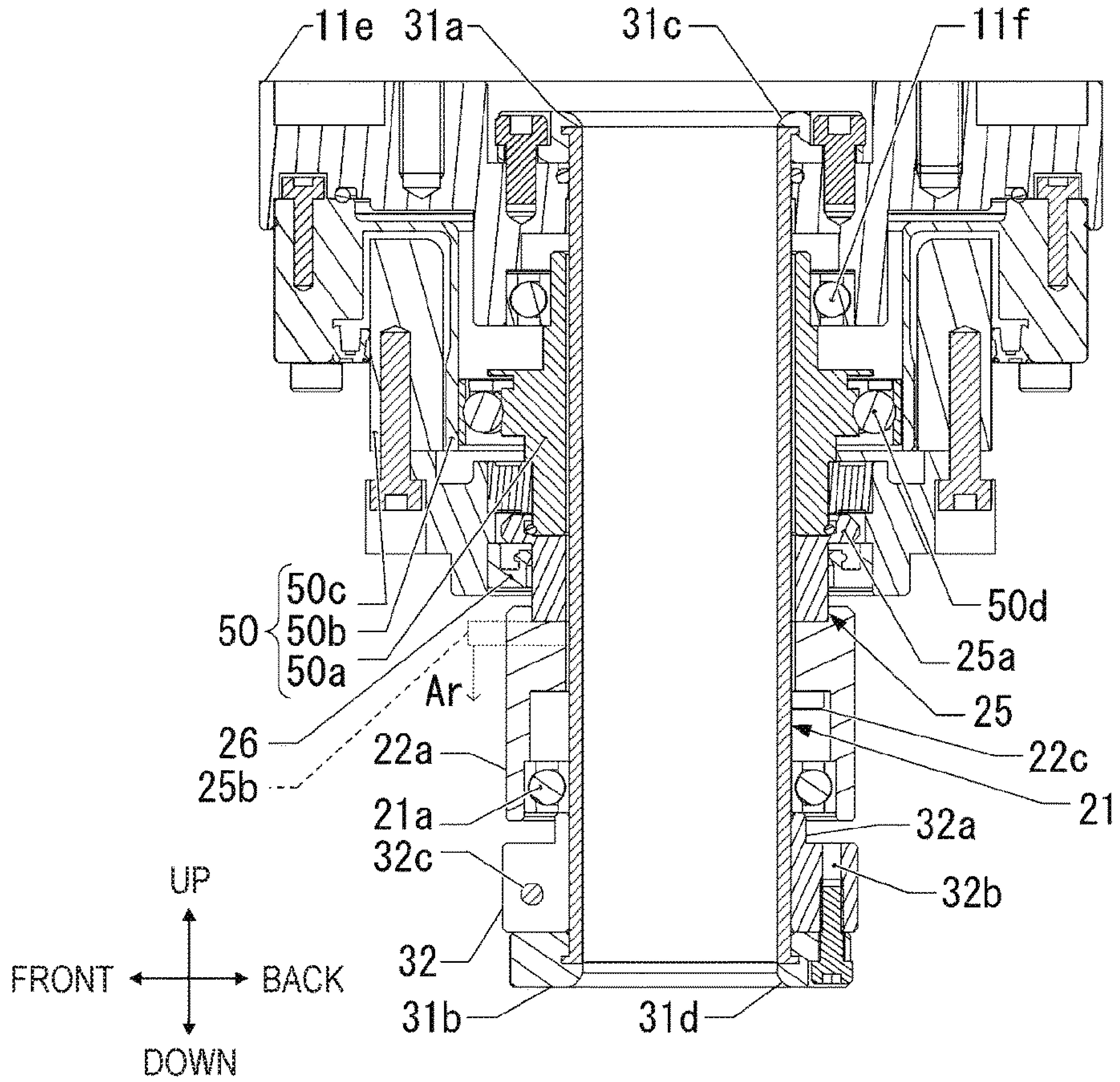

11e
31a
31c
11f
50
50c
50b
50a
50d
25a
25
Ar
26
25b
22a
22c
21
21a
32a
32c
32b
UP
FRONT
BACK
DOWN
32
31b
31d

FIG. 2A

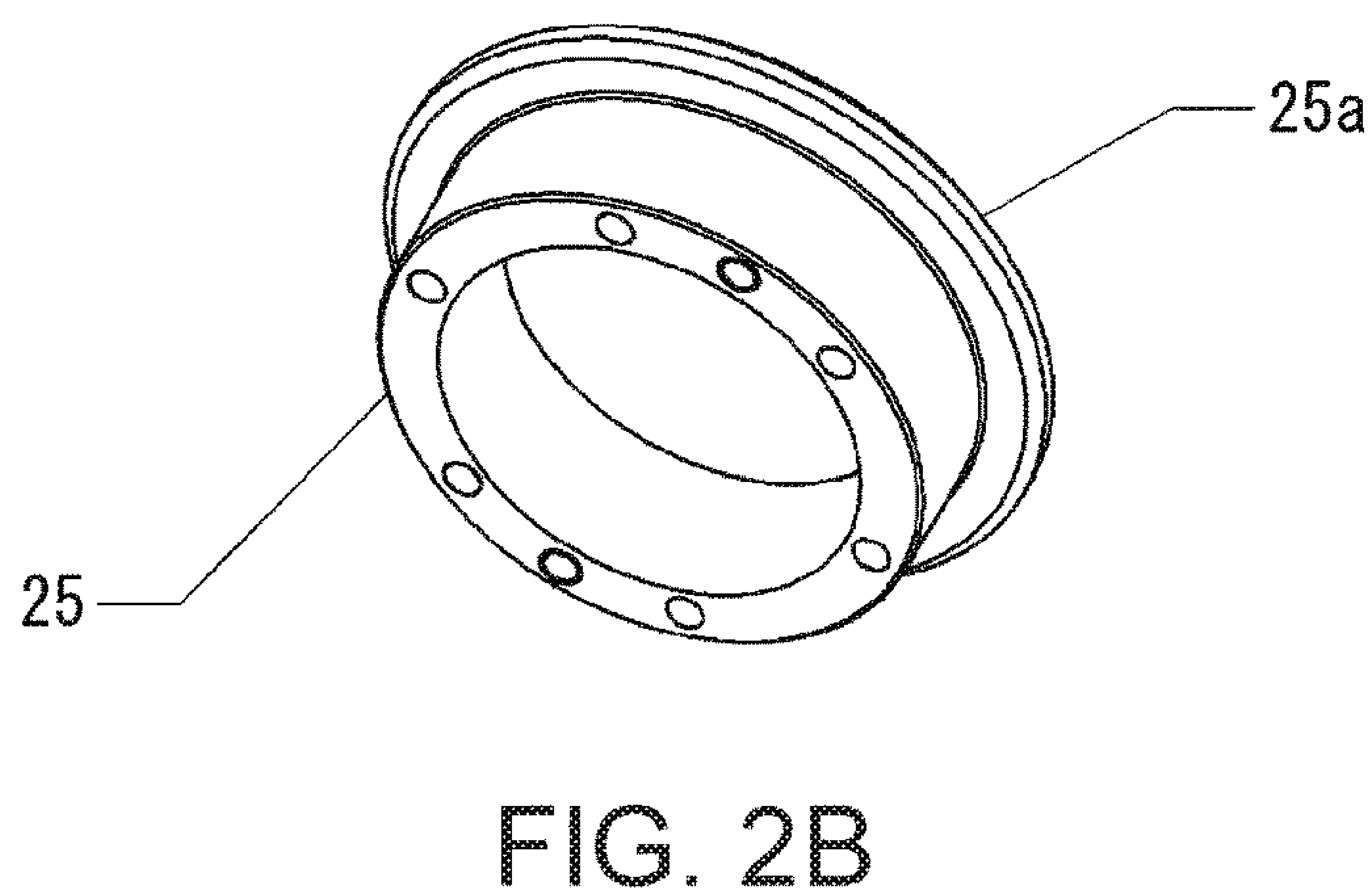

25a
25

FIG. 2B

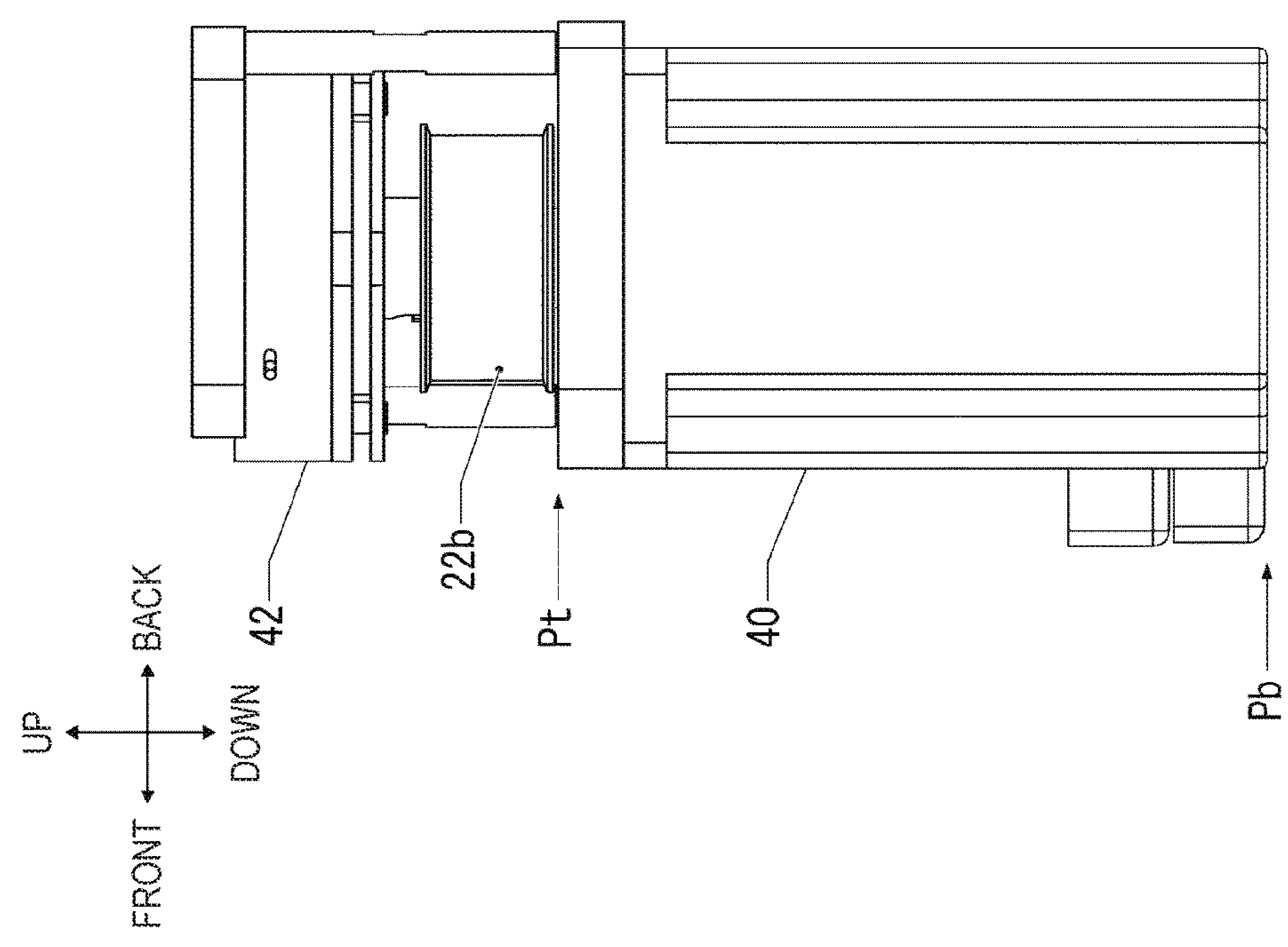

UP
BACK
DOWN
FRONT
42
22b
Pt
40
Pb

FIG. 3A

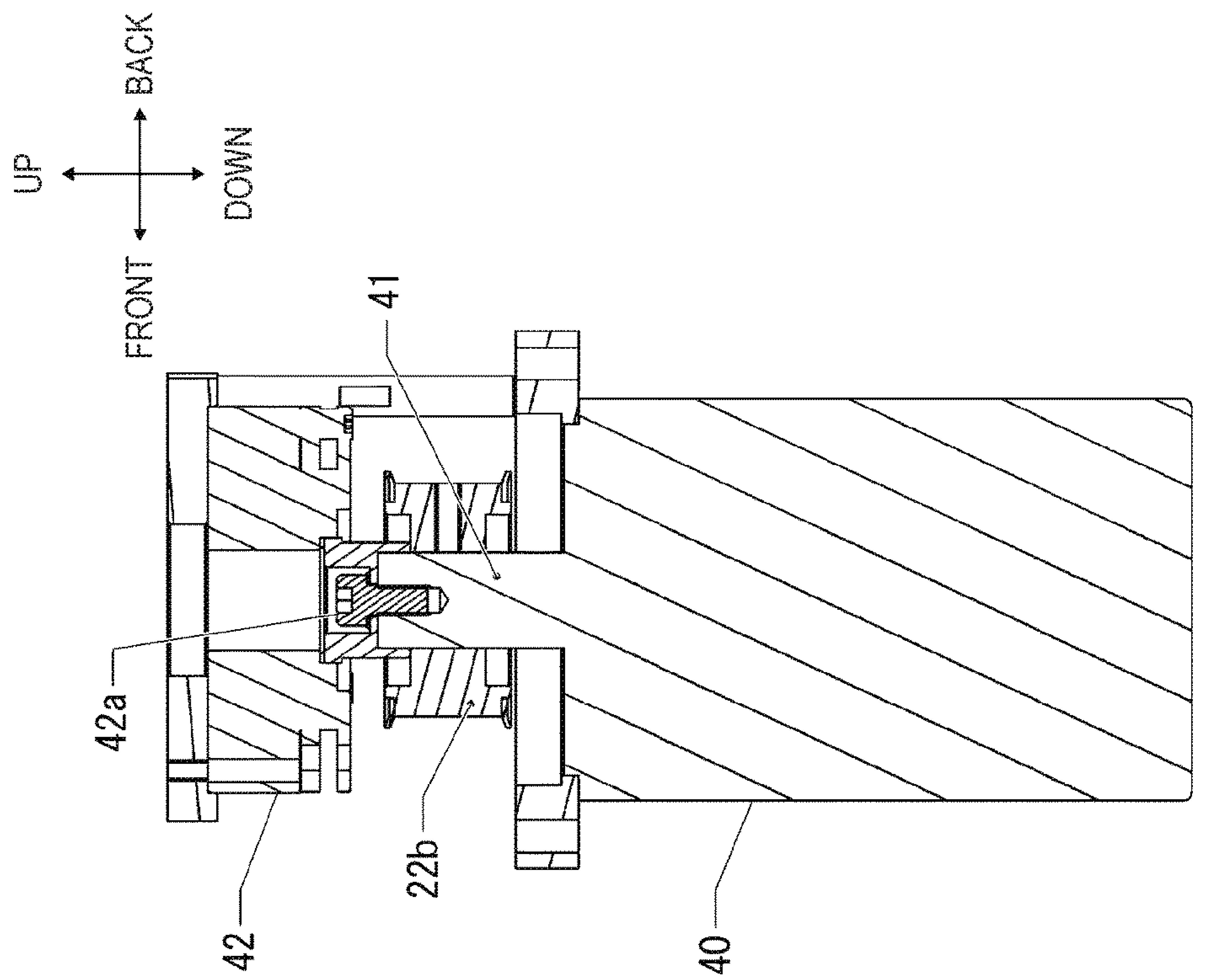

UP
BACK
DOWN
FRONT
41
42a
42
22b
40

FIG. 3B

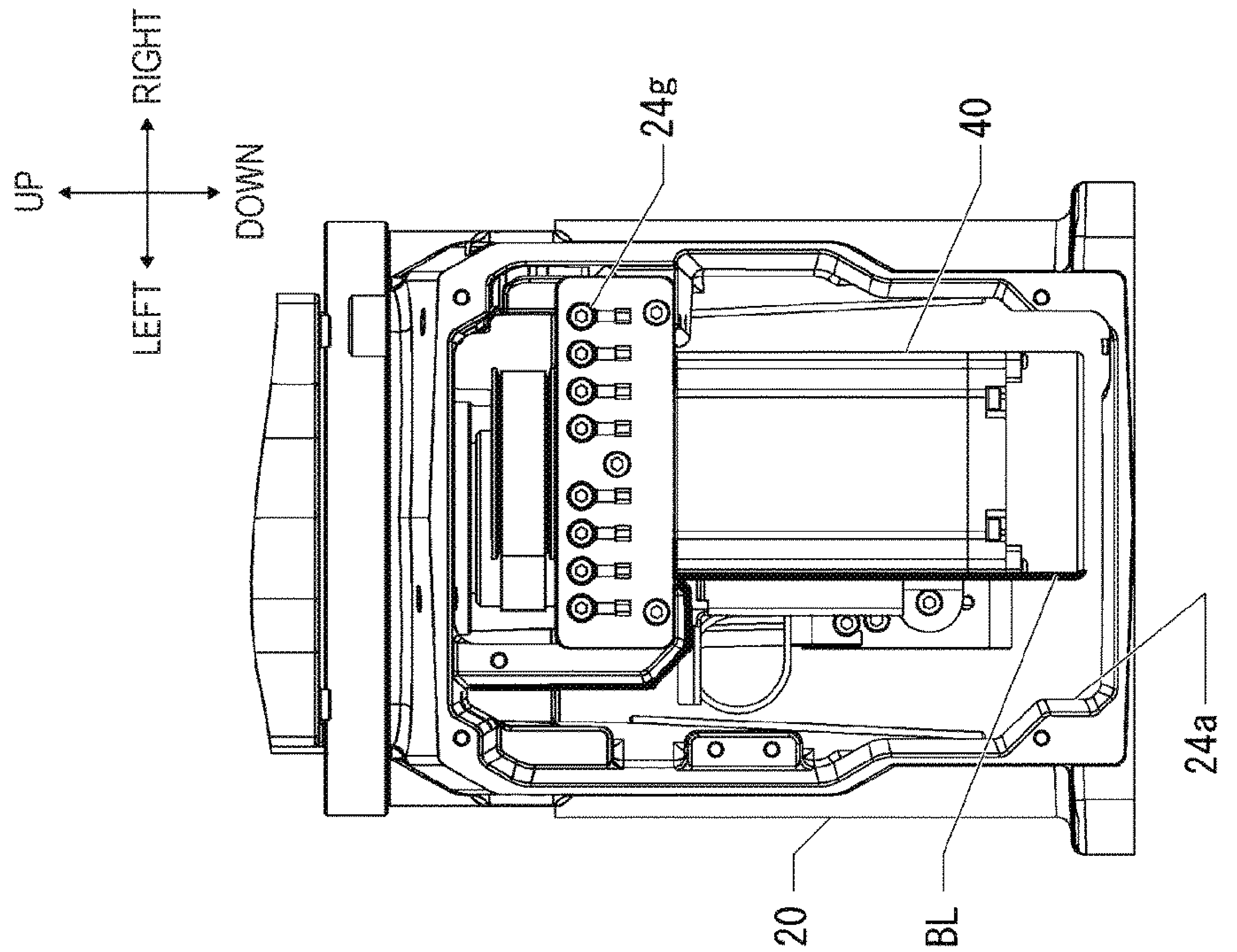

UP
DOWN
LEFT
RIGHT
24g
40
20
BL
24a

FIG. 4B

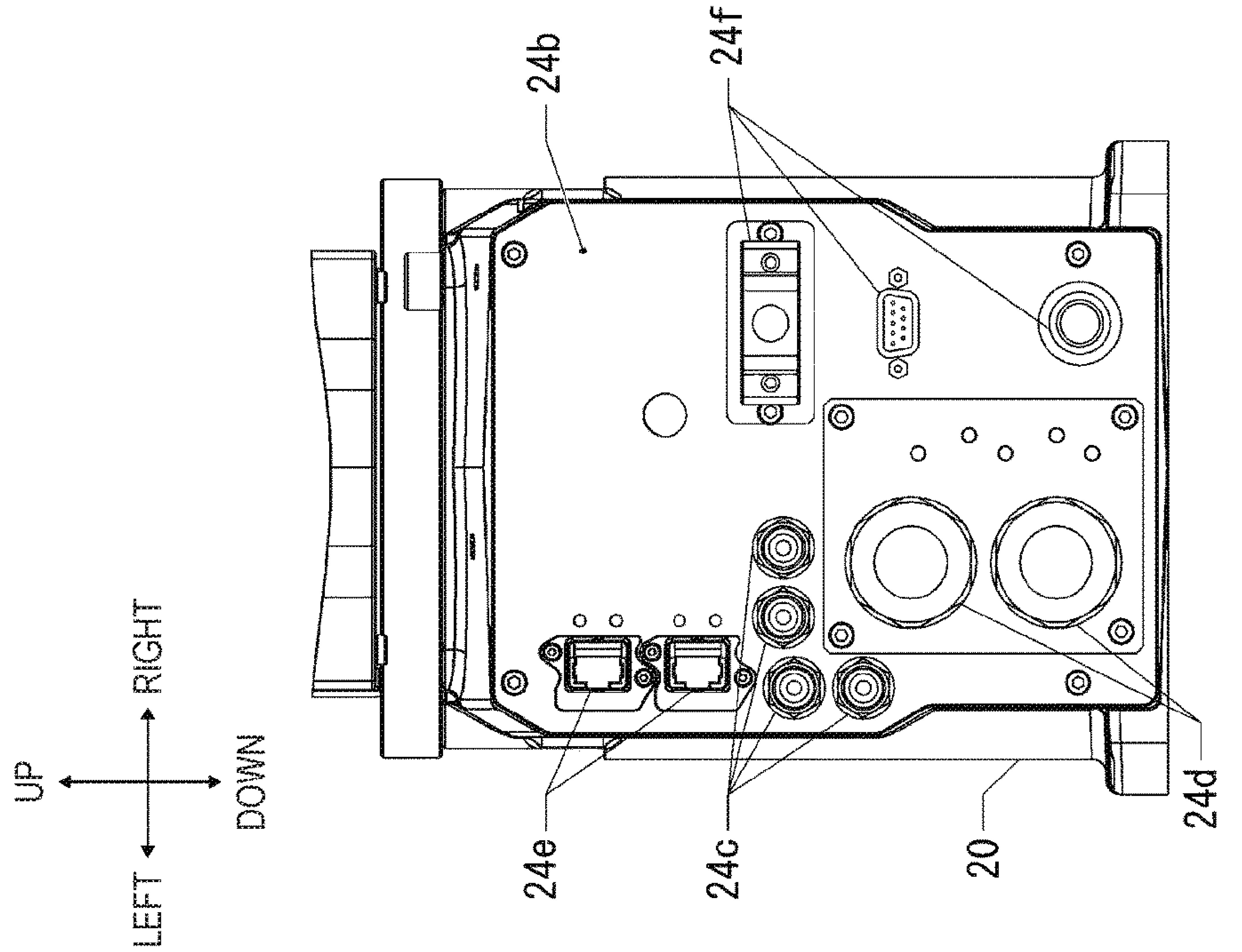

UP
DOWN
LEFT
RIGHT
24b
24f
24e
24c
20
24d

FIG. 4A

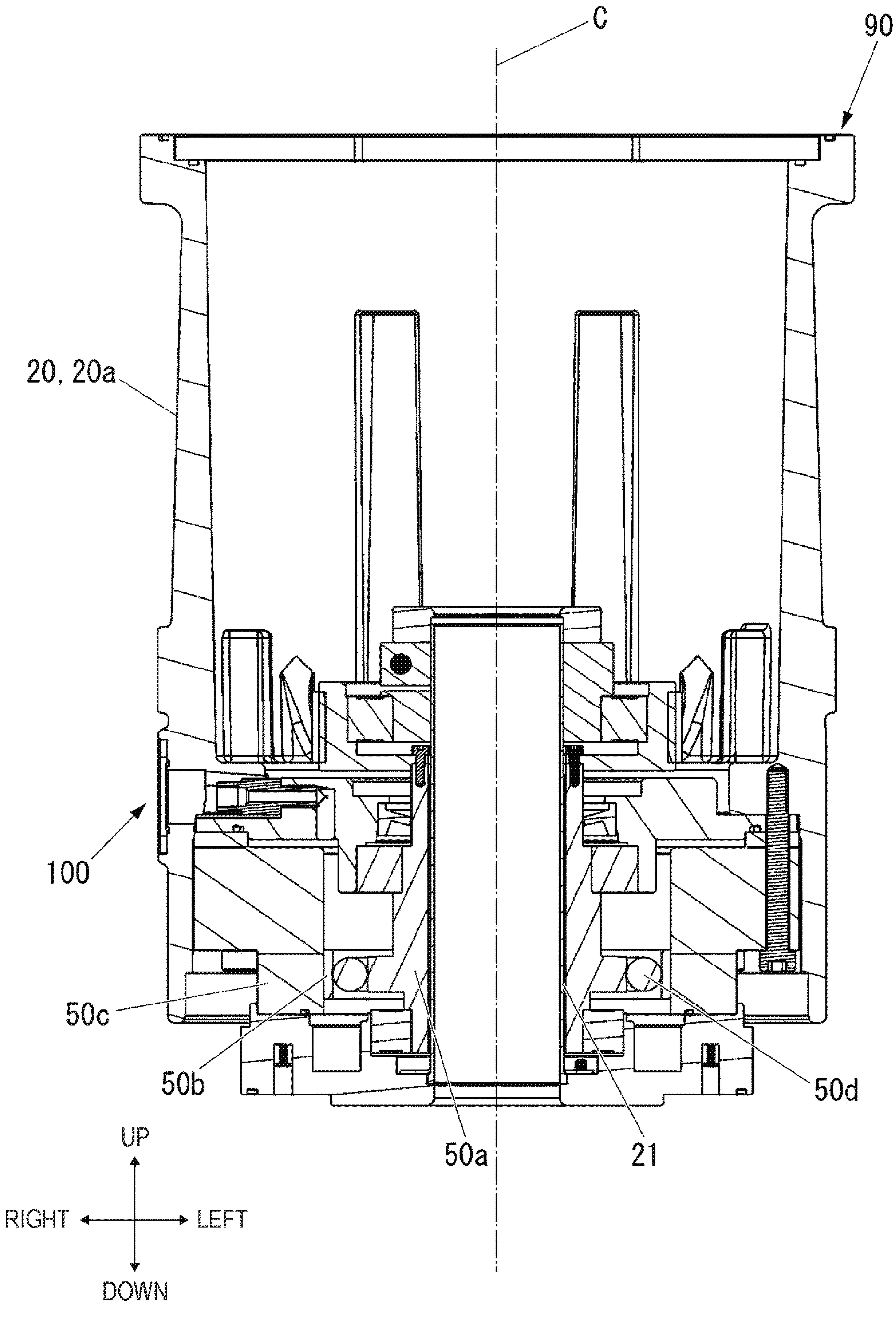


FIG. 5

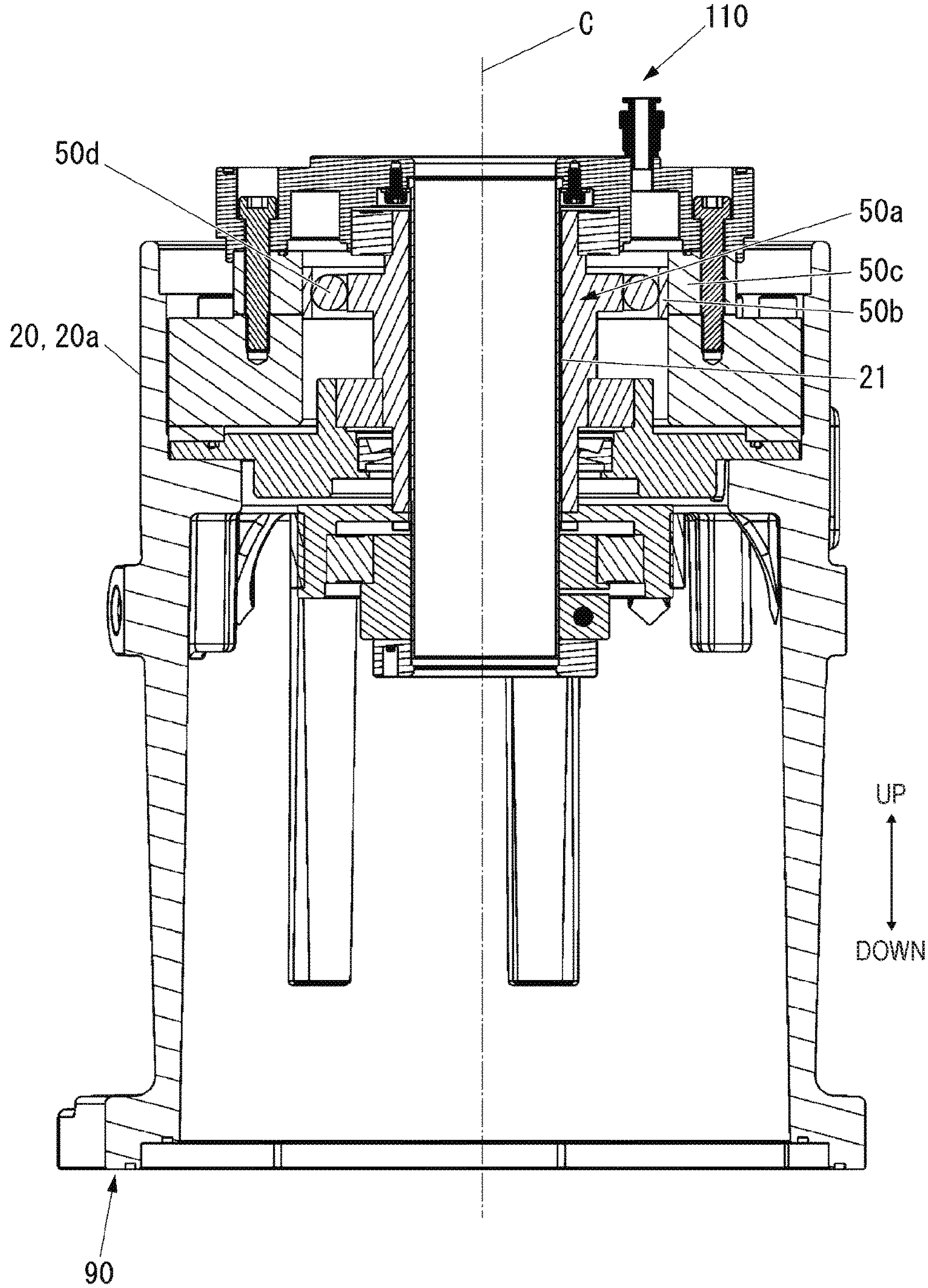


FIG. 6

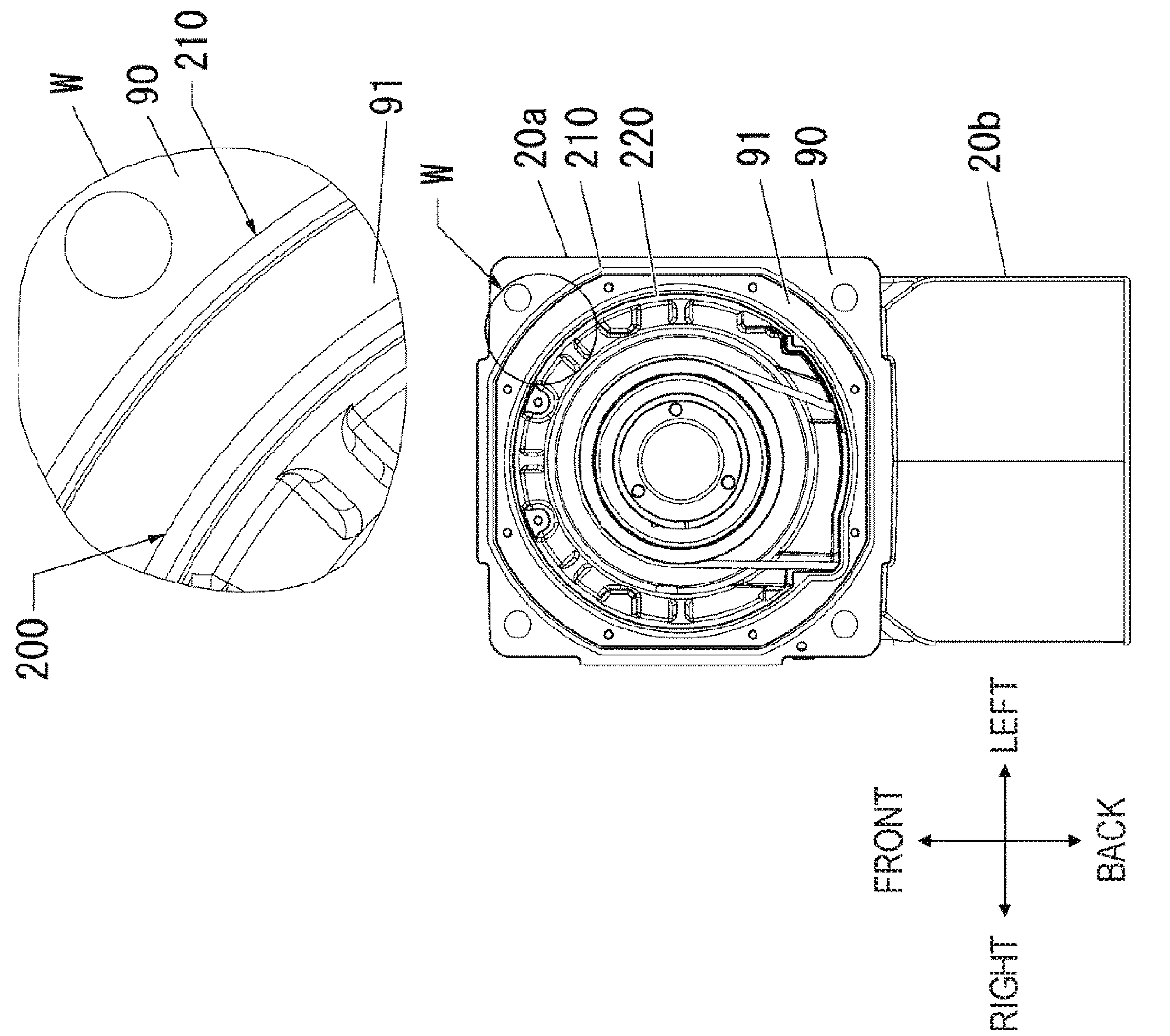

W
90
210
91
200
20a
220
20b
FRONT
BACK
LEFT
RIGHT

FIG. 7B

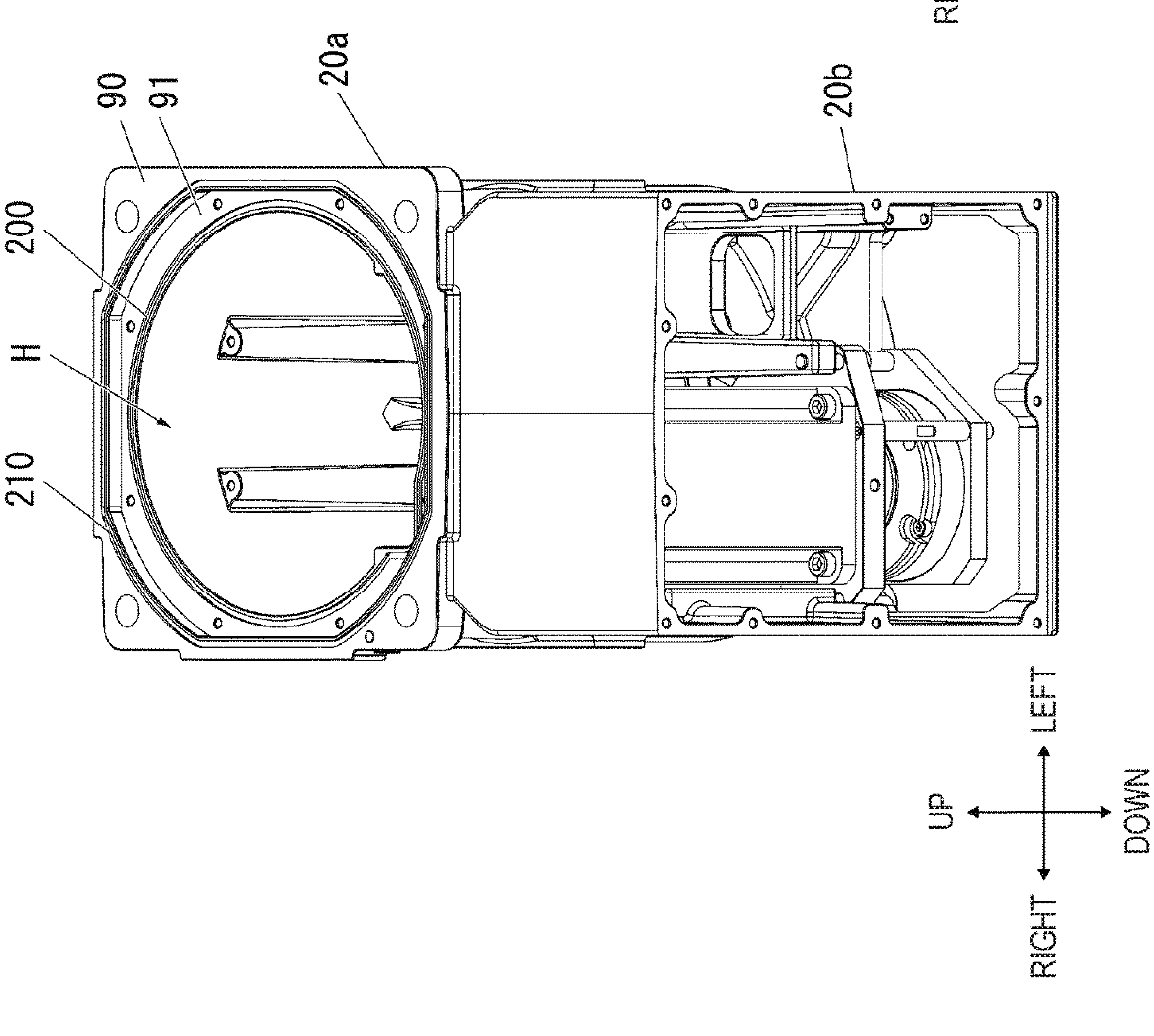

90
91
20a
200
H
210
20b
UP
DOWN
LEFT
RIGHT

FIG. 7A

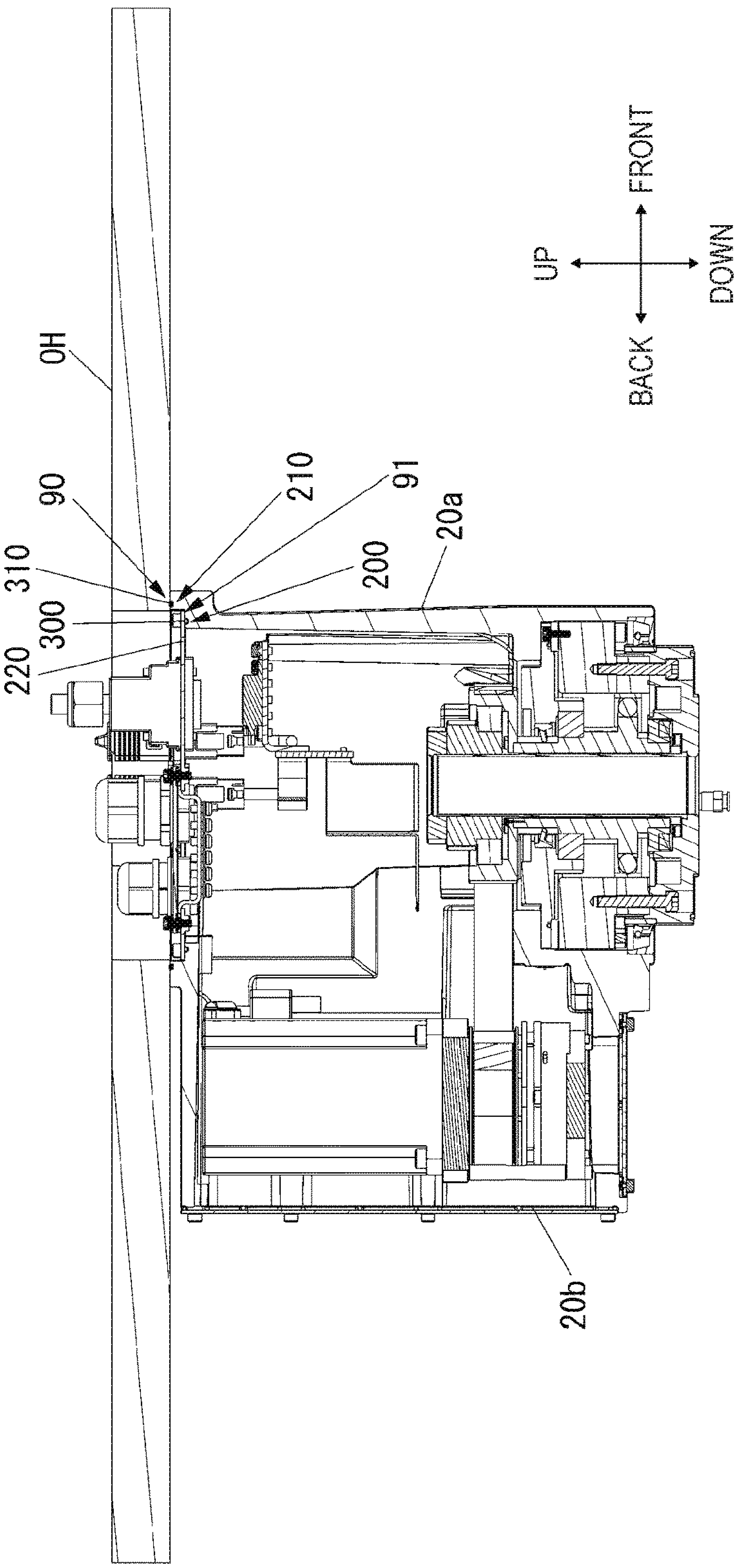


FIG. 8

ROBOT

BACKGROUND

1. Technical Field

The present invention relates to a robot.

2. Related Art

Research and development of robots having arms rotatable with respect to bases or the like are being carried out. The robots include reducers that adjust rotation speeds of the arms.

In this regard, a robot in which an oil supply port that enables supply of a lubricating oil for suppressing wear in a sliding part including a bearing, a gear, etc. of a reducer to the sliding part is provided in an outer wall part of an arm is known (see Patent Document 1 (JP-A-11-254377)).

However, it is assumed that the robot of related art is only installed on a floor and used with respect to oil supply. Accordingly, for example, when an environment in which the robot is suspended from a ceiling is used, the lubricating oil supplied within the reducer in which the sliding part is housed is harder to sufficiently spread over the sliding part and the sliding part may be deteriorated due to wear.

SUMMARY

A robot according to an aspect of the invention includes a base, an arm provided on the base, and a reducer having a sliding part and decelerating driving of the arm, wherein a lubricating oil can be supplied to the sliding part from an opposite side to the arm with respect to the sliding part.

According to this configuration, the robot can supply the lubricating oil to the sliding part from the opposite side to the arm with respect to the sliding part. Thereby, the robot may reduce wear of the sliding part by the lubricating oil supplied from the opposite side to the arm with respect to the sliding part.

Another aspect of the invention may be configured such that, in the robot, the lubricating oil can be supplied to the sliding part from a side of the arm with respect to the sliding part.

According to this configuration, the robot can supply the lubricating oil to the sliding part from the arm side with respect to the sliding part. Thereby, the robot may reduce wear of the sliding part by the lubricating oil supplied from the arm side with respect to the sliding part.

Another aspect of the invention may be configured such that the robot can be suspended from a ceiling.

According to the configuration, the robot can be suspended from the ceiling. Thereby, the robot can operate in the state where the robot is suspended from the ceiling.

In the robot, a configuration that can be placed on a floor may be used.

According to this configuration, the robot can be placed on a floor. Thereby, the robot can operate in the floor placement state.

Another aspect of the invention may be configured such that, in the robot, the base includes a first groove for preventing entrance of a fluid into the base, and a second groove for preventing entrance of a fluid between an object on which the base is installed and the base.

According to this configuration, the robot prevents entrance of a fluid into the base by the first groove and prevents entrance of a fluid between an object on which the base is installed and the base by the second groove. Thereby, the robot may suppress failures caused by entrance of the fluid into the base and between the object and the base.

As described above, the robot can supply the lubricating oil to the sliding part from the opposite side to the arm with respect to the sliding part. Thereby, the robot may reduce wear of the sliding part by the lubricating oil supplied from the opposite side with respect to the arm to the sliding part.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1**A shows a robot according to an embodiment of the invention, and FIG. **1**B is a sectional view of a base and a first arm.

FIG. **2**A is an enlarged sectional view around a reducer, and FIG. **2**B is a perspective view of a detachable member.

FIG. **3**A shows a motor and FIG. **3**B is a sectional view of the motor.

FIG. **4**A shows the base and FIG. **4**B shows an interior of the base.

FIG. **5** shows an example of a base **20** including an oil supply port **100**.

FIG. **6** shows an example of the base **20** including an oil supply port **110**.

FIG. **7**A is a perspective view of an example of an interior of a main body **20***a* of the base **20** as seen from an attachment surface **90** side, and FIG. **7**B shows both a top view of the base **20** shown in FIG. **7**A from the upside shown in FIG. **1**A and an enlarged view of a range W surrounded by a solid line of the top view.

FIG. **8** shows an example of the base **20** installed on a ceiling OH.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Here, embodiments of the invention are explained in the following order.

(1) Configuration of Robot:
(2) Routing of Cable Routings in First Arm and Base:
(3) Configuration around Rotation Shaft Member:
(4) Another Embodiment 1:
(5) Another Embodiment 2:
(6) Another Embodiment 3:

(1) Configuration of Robot:

FIG. **1**A shows a configuration of a robot **10** as one embodiment of the invention. The robot **10** according to the embodiment includes a plurality of arms **11** to **16** and a base **20**. In the specification, the arms are numbered sequentially from the base **20** side for distinction. That is, the first arm **11** is rotatably supported by the base **20** and the second arm **12** is rotatably supported by the first arm **11**. Further, the third arm **13** is rotatably supported by the second arm **12**, the fourth arm **14** is rotatably supported by the third arm **13**, the fifth arm **15** is rotatably supported by the fourth arm **14**, and the sixth arm **16** is rotatably supported by the fifth arm **15**. The rotations of the respective arms are realized by motors etc. (not shown) provided inside of the base **20** and the arms. Note that, in the embodiment, an end effector (not shown) can be attached to the sixth arm **16**.

In FIG. **1**A, the robot **10** is installed by placement of the base **20** in an installation location and fastening to the installation location with bolts or the like. In the specification, directions are coordinated with directions perpendicular to the plane on which the base **20** is installed are upward and downward directions and a direction in which the main drive ranges of the respective arms exist in the plane on which the base **20** is installed as a frontward direction and shown in FIG. **1**A. Hereinafter, up, down, front, back, left, right are shown in reference to the directions shown in FIG. **1**A.

The base **20** has a general shape in which a main body **20***a* in a nearly cylindrical shape and a rectangular part **20***b* in a rectangular shape are coupled. In FIG. **1**A, the main body **20***a* is provided on the front side and the rectangular part **20***b* is provided on the back side. On the main body **20***a*, the first arm **11** is supported by the main body **20***a* so as to rotate about a rotation shaft extending in the up-to-down direction in FIG. **1**A as a rotation center. The first arm **11** includes a main body **11***a* and a supporting part **11***b*, and is supported by the base **20** with the main body **11***a* disposed on the main body **20***a* of the base **20**. The supporting part **11***b* is a part that sandwiches and supports the second arm **12**. The second arm **12** includes a main body **12***a* and a supporting part **12***b*, and is supported by the supporting part **11***b* with the main body **12***a* sandwiched by the supporting part **11***b* so as to rotate about a rotation shaft extending in the right-to-left direction in FIG. **1**A as a rotation center. The supporting part **12***b* is a part that sandwiches and supports the third arm **13**.

The third arm **13** has a nearly rectangular parallelepiped shape and is supported by the supporting part **12***b* with the third arm **13** sandwiched by the supporting part **12***b* so as to rotate about a rotation shaft extending in the right-to-left direction in FIG. **1**A as a rotation center. The fourth arm **14** is supported by an end surface of the third arm (an end surface on the front side in the state shown in FIG. **1**A) so that the fourth arm **14** may rotate about a rotation shaft in parallel to a direction (a front-to-back direction in the state shown in FIG. **1**A) perpendicular to the rotation shaft of the third arm **13** (in the right-to-left direction in the state shown in FIG. **1**A).

The fourth arm **14** includes a main body **14***a* and a supporting part **14***b*, and is supported by the third arm **13** so that the main body **14***a* may rotate about a rotation shaft extending in the front-to-back direction in FIG. **1**A as a rotation center. That is, in the embodiment, the direction in which the fourth arm **14** extends and the direction in which the rotation shaft extends are in parallel and the fourth arm **14** is twistable. The supporting part **14***b* is a part that sandwiches and supports the fifth arm **15**. The fifth arm **15** is sandwiched by the supporting part **14***b* and supported by the supporting part **14***b* so as to rotate about a rotation shaft extending in the right-to-left direction in FIG. **1**A as a rotation center. Further, the sixth arm **16** is supported by the fifth arm **15** so as to rotate about a rotation shaft extending in the front-to-back direction in FIG. **1**A as a rotation center. That is, the sixth arm **16** is also adapted to be twistable.

A plurality of cable routings for transferring power, signals, fluids (air) to the other parts can be connected to the base **20**. That is, these cable routings are connected to the base **20** and the cable routings are routed inside of the base **20**, and thereby, power, signals, fluids, etc. are transferred to the base **20** and an arbitrary arm of the first arm **11** to the sixth arm **16** and used.

FIG. **1**B is a sectional view of the base **20** and the first arm **11** cut in the front-to-back direction shown in FIG. **1**A showing configurations inside of the base **20** and inside of the first arm **11** with respect to the rotation of the first arm (Note that only the lower part of the first arm **11** is extracted). Further, FIG. **2**A is an enlarged view of extraction of members around a reducer **50** and a rotation shaft member **21**. In the embodiment, the first arm **11** is provided on the upside of the base **20** in the vertical direction, and the first arm **11** is rotatably supported with respect to the center axis of the rotation shaft member **21** existing over the base **20** and the first arm **11**. That is, the rotation shaft member **21** is a cylindrical member and provided within the base **20** and the first arm **11** so that the axis of the cylinder may be aligned with a rotation axis Ax_1 as a rotation center of the first arm **11**.

A mechanism for transmitting a rotation drive force of the motor to the first arm **11** is provided around the rotation shaft member **21**. In the embodiment, the mechanism includes a rotation shaft member pulley **22***a*, a detachable member **25**, and the reducer **50**. Note that, in the embodiment, the reducer **50** is a strain wave gearing including a wave generator **50***a*, a flexspline **50***b*, and a circular spline **50***c*.

The rotation shaft member pulley **22***a* has an inner diameter slightly larger than the outer diameter of the rotation shaft member **21**, and attached to the side slightly below the center in the up-to-down direction of the rotation shaft member **21** via a bearing **21***a*. The rotation shaft member pulley **22***a* rotates by the rotation drive force of the motor (not shown) provided within the base **20**. That is, a belt is looped over the rotation shaft member pulley **22***a* and the belt is looped over a motor pulley (not shown). The motor pulley is coupled to the output shaft of the motor and the motor is rotationally driven, and thereby, the rotation drive force is transmitted to the rotation shaft member pulley **22***a* via the motor pulley and the belt. Note that, in FIG. **1**B, the motor and the motor pulley are omitted, however, the motor and the motor pulley are provided in the rectangular part **20***b* (see FIG. **1**A) within the base **20**.

The rotation speed of the first arm **11** in the embodiment is adjusted by the reducer **50** to rotate at a rotation speed appropriate for the rotation of the first arm **11**. That is, in the embodiment, the rotation shaft member pulley **22***a* is coupled to the detachable member **25** by a bolt **22***c*, and the detachable member **25** is coupled to the wave generator **50***a* by the bolt **22***c*. Therefore, the rotation shaft member pulley **22***a*, the detachable member **25**, and the wave generator **50***a* integrally rotate, not relatively rotate.

The wave generator **50***a* includes a bearing **50***d* and the flexspline **50***b* is attached to the outer circumference side of the bearing **50***d*. The flexspline **50***b* is adapted to mesh with the circular spline **50***c*. Note that the circular spline **50***c* is fixed to the base **20** by a bolt. Further, the flexspline **50***b* is fixed to a flange **11***e* by a bolt. The flange **11***e* is a component member of the first arm **11** and fixed to the main body **11***a* of the first arm **11** by a bolt.

The outer circumference of the wave generator **50***a* has an oval shape (the outer circumference as seen from above to below has the oval shape). The flexspline **50***b* has a part in a cylindrical shape with a thin wall surface, and the wave generator **50***a* is attached to be fitted in the inner circumference of the wall surface. Accordingly, when the wave generator **50***a* rotates about the rotation axis Ax_1 as a rotation center, the shape of the thin wall surface of the flexspline **50***b* elastically deforms according to the shape of the outer circumference of the wave generator **50***a*. Teeth are provided on the outer circumference of the flexspline **50***b*, and teeth are also provided on the inner circumference of the circular spline **50***c*. Therefore, the flexspline **50***b* meshes with the circular spline **50***c* in the long axis parts of the oval shape. Further, the difference in number of teeth between the splines is n (n is a natural number equal to or more than one). Therefore, when the wave generator **50***a* makes one revolution, the oval makes one revolution while the flexspline **50***b* meshes with the circular spline **50***c* in the long axis parts of the oval, and the wave generator **50***a* and the flexspline **50***b* relatively rotate by an angle according to the difference in number of teeth in one revolution of the oval. In the embodiment, according to the above described configuration, the reducer **50** rotates the flexspline **50***b* while reducing the rotation speed of the wave generator **50***a*.

In the embodiment, according to the above described configuration, the first arm **11** is rotated by the rotation drive force of the motor. That is, when the rotation shaft member pulley **22***a* rotates by the rotation drive force of the motor, the detachable member **25** and the wave generator **50***a* coupled to the rotation shaft member pulley **22***a* integrally rotate. As described above, when the wave generator **50***a* rotates, the rotation is transmitted to the flexspline **50***b* while the rotation is decelerated, however, the flexspline **50***b* couples to the flange **11***e* and the flange **11***e* (i.e., the first arm **11**) rotates about the rotation axis Ax_1 as a rotation center at the number of revolutions after the deceleration.

Note that, in the embodiment, the rotation shaft member **21** is fixed to the flange **11***e* using the upper end portion of the rotation shaft member **21**. Specifically, the rotation shaft member **21** has upper end and lower end portions slightly projecting in directions perpendicular to the up-to-down direction to form flangelike parts. Annular cable routing protective members **31***a*, **31***b* are attached to the projecting parts. These cable routing protective members **31***a*, **31***b* have inner diameters slightly larger than the outer diameter of the rotation shaft member **21**, and grooves in which the upper end and lower end flangelike parts of the rotation shaft member **21** can be inserted are formed on the wall surfaces forming the inner diameters.

Further, bolt holes penetrating in directions in parallel to the inner walls are formed in the cable routing protective members **31***a*, **31***b*, and the cable routing protective member **31***a* is fixed to the flange **11***e* via the bolt holes on the upper end of the rotation shaft member **21**. Therefore, the rotation shaft member **21** rotates with the rotation of the flange **11***e*. Obviously, the configuration is an example, and the rotation shaft member **21** may be directly fixed to the flange **11***e*.

On the other hand, the cable routing protective member **31***b* is fixed to a drop prevention member **32** via the bolt holes on the lower end of the rotation shaft member **21**. The drop prevention member **32** has a cylindrical shape and a projecting port ion **32***a* projecting upward. The drop prevention member **32** has a bolt hole **32***b* in which a bolt can be inserted in the up-to-down direction and a bolt hole **32***c* in which a bolt can be inserted in a direction perpendicular to the up-to-down direction. The bolt is inserted into the bolt hole **32***c* with the upper end of the projecting portion **32***a* in contact with the lower end of the bearing **21***a*, and thereby, the drop prevention member **32** is fixed to the rotation shaft member **21**. Further, the bolt is inserted into the bolt hole **32***b*, and thereby, the drop prevention member **32** is fixed to be integrated with the cable routing protective member **31***b*.

Note that, in the state in which the cable routing protective members **31***a*, **31***b* are fixed to the rotation shaft member **21**, parts **31***c*, **31***d* located on the upper end of the inner wall of the cable routing protective member **31***a* and the lower end of the inner wall of the cable routing protective member **31***b* are curved surfaces having inner diameters gradually larger toward the outside (the upper end side or the lower end side).

(2) Routing of Cable Routings in First Arm and Base:

In the above described configuration, the shaft of the rotation shaft member **21** penetrates the hollow shaft of the reducer **50**, and the axis of the rotation shaft member **21**, the axis of the reducer **50**, and the rotation axis Ax_1 of the first arm **11** are aligned. In the embodiment, the rotation shaft member **21** is provided inside of the base **20** and the first arm so that the rotation axis Ax_1 may be parallel to the up-to-down direction (the vertical direction when the base **20** is installed on the horizontal surface). That is, the reducer **50** according to the embodiment has the hollow shaft and the rotation shaft member **21** penetrates the hollow shaft of the reducer **50**.

In the embodiment, the above described cable routings **30** pass through the hollow part of the rotation shaft member **21**. That is, as shown in FIGS. **1**B and **2**A, the rotation shaft member **21** is a hollow tubular member and the cable routings **30** pass through the hollow part inside (see FIG. **1**B). Therefore, the cable routings **30** exist over the base **20** and the first arm **11**. The cable routings **30** are cable routings routed inside of the base **20** and inside of the first arm **11** and the cable routings for transferring power, signals, fluids, etc. from the outside to the inside or from the inside to the outside of the base **20** are bundled.

The cable routings **30** are bundled at least in a location inside of the base **20** and at least in a location inside of the first arm **11**. In the embodiment, the cable routings are bundled in a first bundle position existing on the rotation axis Ax_1 and inside of the base **20** and in a second bundle position existing on the rotation axis Ax_1 and inside of the first arm **11**. There is no other bundle position between the first bundle position and the second bundle position. Specifically, as shown in FIG. **1**B, a plate-like member **23***a* is coupled to the base **20** in the lower part within the base **20**. Further, a bundling tool **23***b* that can be fastened to the plate-like member **23***a* while being in contact with a part of the outer circumference of the cable routings **30** and the plate-like surface of the plate-like member **23***a* is formed in advance, and the bundling tool **23***b* is fastened to the plate-like member **23***a* with the cable routings **30** placed between the plate-like member **23***a* and the bundling tool **23***b*. As a result, the cable routings **30** are bundled inside of the base **20** in a position of the bundling tool **23***b* as the above described first bundle position.

On the other hand, as shown in FIG. **1**B, a plate-like member **11***c* is coupled to the first arm **11** in the lower part of the first arm **11**. Further, a bundling tool **11***d* that can be fastened to the plate-like member **11***c* while being in contact with a part of the outer circumference of the cable routings **30** and the plate-like surface of the plate-like member **11***c* is formed in advance, and the bundling tool **11***d* is fastened to the plate-like member **11***c* with the cable routings **30** placed between the plate-like member **11***c* and the bundling tool **11***d*. As a result, the cable routings **30** are bundled inside of the first arm **11** in a position of the bundling tool **11***d* as the above described second bundle position. Obviously, the bundling method in the first bundle position and the second bundle position is an example, and another method may be used. For example, the cable routings **30** may be sandwiched by a plate-like member so that the cable routings **30** may be bundled by the action of a plate spring.

In the embodiment, the plate-like member **23***a*, the bundling tool **23***b*, the plate-like member **11***c*, and the bundling tool **11***d* are provided in positions in which the cable routings **30** may be bundled on the rotation axis Ax_1 of the rotation shaft member **21**. Therefore, in the embodiment, the cable routings **30** are bundled in the first bundle position and the second bundle position on the rotation axis Ax_1. Further, the rotation axis Ax_1 is a straight line, and the cable routings **30** takes a linear shape between the first bundle position and the second bundle position.

Note that, in the embodiment, the part near the rotation shaft of the reducer **50** is hollow and the rotation shaft member **21** is provided in the hollow part. The rotation shaft member **21** is the cylindrical member, and thereby, the cable routings **30** are easily placed on the rotation axis Ax_1 by passing the cable routings through the rotation shaft member **21**. Further, in the embodiment, the rotation axis Ax_1 is parallel to the vertical direction. Therefore, even when the cable routings **30** are bundled in the first bundle position and the second bundle position as two positions on the rotation axis Ax_1, the cable routings **30** existing between the first bundle position and the second bundle position are placed on the rotation axis Ax_1 under their own weight. Accordingly, the cable routings **30** autonomously takes the linear shape. Therefore, the lifetime of the cable routings **30** may be elongated by a simple configuration.

In the above described configuration, when the first arm **11** rotates relative to the base **20**, the cable routings **30** are twisted with the rotation of the first arm **11**. However, in the embodiment, there is no crankshaft that pulls the first arm **11** with the rotation, and the cable routings **30** is not pulled by a component serving as the crankshaft. Therefore, compared to the structure in which a pulling force by the crankshaft acts, most of the force acting on the cable routings **30** may be limited to stress due to twist. As a result, the lifetime of the cable routings **30** can be elongated.

Further, in the embodiment, the cable routing protective members **31***a*, **31***b* are attached to the upper end portion and the lower end portion of the rotation shaft member **21**, and the parts **31***c*, **31***d* located on the upper end of the inner wall of the cable routing protective member **31***a* and the lower end of the inner wall of the cable routing protective member **31***b* are curved surfaces having inner diameters gradually larger from the inside toward the outside (from the inside toward the upper end side or from the inside toward the lower end side). Therefore, the contact surfaces on which the cable routings **30** are in contact with the parts near the upper end and the lower end of the rotation shaft member **21** are the curved surfaces, and the extent at which the cable routings **30** are broken when the cable routings **30** come into contact with the cable routing protective members **31***a*, **31***b* is suppressed. Therefore, the lifetime of the cable routings **30** can be elongated.

Furthermore, the parts **31***c*, **31***d* of the cable routing protective members **31***a*, **31***b* and the inner wall of the rotation shaft member **21** may be coated with a material having a relatively small friction resistance, e.g. fluorine resin or the like. According to the configuration, the extent at which the cable routings **30** are broken due to contact with the cable routings **30** may be suppressed. Therefore, the lifetime of the cable routings **30** can be elongated.

The first bundle position and the second bundle position are not limited to the positions shown in FIGS. **1**B and **2**A, but may be changed according to the lifetime of the cable routings **30**. That is, the distance between the first bundle position and the second bundle position is increased, and thereby, the lifetime of the cable routings **30** may be elongated.

(3) Configuration Around Rotation Shaft Member:

The cable routings **30** within the base **20** are generally thicker (bundled and become thicker) than the cable routings within the other arms. Therefore, to allow the thick cable routings **30** to pass through the rotation shaft member **21**, it is necessary that the inner diameter of the rotation shaft member **21** is sufficiently large. Further, as described above, to elongate the lifetime of the cable routings **30**, it is necessary to increase the distance between the first bundle position and the second bundle position.

To place a tubular rotating member to rotate about a rotation axis, generally, the member may be held in two locations of the tube, however, in the embodiment, to place the thick and long rotation shaft member **21** within the base **20**, the rotation shaft member **21** is held in three locations, i.e., by the bearings **21***a*, **50***d*, **11***f*. Here, the bearings **50***d*, **11***f* have structures not dropping in relation to surrounding parts, however, unless another member is provided immediately under the bearing **21***a*, the bearing **21***a* could drop due to the rotation of the rotation shaft member pulley **22***a*. Accordingly, in the embodiment, as shown in FIG. **2**A, the drop prevention member **32** is attached to the rotation shaft member **21** below the rotation shaft member pulley **22***a* in the vertical direction. The drop prevention member **32** is attached to the rotation shaft member **21** so that the projecting portion **32***a* projecting upward may be in contact with the bearing **21***a* (at least a component element of the bearing **21***a*). Here, the drop prevention member **32** is fixed to the rotation shaft member **21** by the bolt hole **32***c*, and thereby, even when the rotation shaft member **21** rotates at a high speed, the drop prevention member **32** does not drop downward. Therefore, the drop prevention member **32** acts to prevent drop of the bearing **21***a* of the rotation shaft member pulley **22***a*.

Further, the above described detachable member **25** is used in combination with a sealing member **26** for preventing leakage of the lubricating oil, and thereby, the leakage of the lubricating oil within the reducer **50** may be prevented without disassembly of the reducer **50**. That is, in the embodiment, the sealing member **26** is not directly attached to the wave generator **50***a*, but attached to the detachable member **25** with the detachable member **25** placed between the sealing member **26** and the wave generator **50***a*.

In other words, the reducer **50** is formed by a combination of a plurality of movable components, and the lubricating oil is enclosed inside so that the respective movable components may smoothly move in contact with one another. The sealing member **26** is used for preventing leakage of the lubricating oil, and, to prevent drop of the sealing member **26** in the operation process while using the detachable member **25**, it is necessary that the sealing member **26** is strongly attached to the reducer **50**. However, in the configuration in which the sealing member **26** is directly and strongly attached to the reducer **50**, it is difficult to detach the sealing member **26** singly for maintenance and disassembly of the reducer **50** is required.

Accordingly, in the embodiment, the detachable member **25** is adapted to be detachable from the reducer **50**. That is, in the above described detachable member **25** is an annular member detachable from the reducer **50** and attached to the reducer **50** with the rotation shaft member **21** penetrating therein. Specifically, a lug portion **25***a* is formed in the upper part of the detachable member **25**, and the lug portion **25***a* is attached to bite into the outer wall of the wave generator **50***a*. The detachable member **25** is attached to the wave generator **50***a*, and then, the annular sealing member **26** for preventing leakage of the lubricating oil within the reducer **50** is attached between the outer wall of the detachable member **25** and the base **20**. The sealing member **26** can be fitted so that the lubricating oil within the reducer **50** may not leak downward with respect to the detachable member **25**. According to the configuration, the leakage of the lubricating oil of the reducer **50** can be prevented by the sealing member **26** in the operation process.

It is only necessary that the detachable member **25** is detachable from the wave generator **50***a*, and various techniques can be employed as the technique for attachment and detachment. In the embodiment, detachment is performed by attachment of another component to the detachable member **25**. For example, the detachable member **25** can be detached using a plate-like member **25***b* with bolt holes formed therein (see a broken line in FIG. **2**A). That is, the detachable member **25** has a plurality of bolt holes as shown in FIG. **2**B and, when a force in a direction of an arrow Ar acts on the plate-like member **25***b* with coupling to the plate-like member using the bolt holes and the bolt holes formed in the plate-like member **25***b*, the detachable member **25** can be detached with the sealing member **26**. According to the above described configuration, the detachable member **25** and the sealing member **26** can be detached from the reducer **50** without disassembly of the reducer **50**. Note that it is preferable that the sealing member **26** is a rubber member with high heat resistance formed using e.g. a fluorine resin or the like because the member rotates with the detachable member **25**.

(4) Another Embodiment 1:

The above described embodiment is an example for embodying the invention, and other various configurations can be employed. For example, the form of the robot **10** is not limited to the embodiment shown in FIG. **1**A, but may be any other robot such as a dual-arm robot, a humanoid robot, or a scalar robot. Obviously, the configuration of the arm is not limited to the form shown in FIG. **1**A. A seven-axis robot including seven arms may be employed and the number of arms is not limited.

Further, various inventions may be applied to various components provided in the base **20** of the robot **10**. In many cases, it is preferable that the robot **10** has a smaller size than a large size, and an invention for downsizing may be applied. For example, the base **20** can be downsized by providing brakes of the motors within the base **20** in arrangement different from the normal arrangement. FIGS. **3**A and **3**B extract and show a motor **40** provided in the base **20** and members relating to the motor **40**. FIG. **3**A shows the motor **40** within the base **20** as seen from the left side to the right side shown in FIG. **1**A, and FIG. **3**B is a sectional view of FIG. **3**A. In these drawings, the similar configurations to those of the robot **10** shown in FIG. **1**A are shown by the same signs.

The motor **40** shown in FIGS. **3**A, **3**B includes a casing elongated in one direction and is attached within the base **20** with the longitudinal direction in the up-to-down direction. The motor **40** includes an output shaft **41** projecting upward in the vertical direction, and a motor pulley **22***b* is attached to the output shaft **41**. Further, a belt (not shown) is looped over the motor pulley **22***b*, and the rotation of the motor pulley **22***b* is transmitted to the rotation shaft member pulley **22***a* via the belt.

A motor brake **42** that suppresses the rotation of the output shaft **41** is attached to the upper end of the output shaft **41**. In the embodiment, the motor brake **42** is attached to the upper end of the output shaft **41** with a bolt **42***a* and cable routings as a communication line and a power line (not shown) are attached thereto. That is, when a signal as a command of suppressing the rotation of the output shaft **41** is transmitted to the motor brake **42** by the cable routings, the motor brake **42** is driven by the power and allows a friction force to act on the member coupled to the output shaft **41**. As a result, the rotation of the output shaft **41** is suppressed. According to the configuration, in the robot **10**, the rotation of the output shaft **41** in the motor **40** can be stopped (or the rotation can be suppressed) at an arbitrary time.

On the other hand, in a motor of related art, a motor brake is attached to a main body of the motor. For example, in the motor with the longitudinal direction in the up-to-down direction as shown in FIG. **3**A, the motor brake is attached to a bottom surface of the motor main body (position Pb shown in FIG. **3**A) or an upper surface of the motor main body (position Pt shown in FIG. **3**A). In this case, the height of the motor pulley **22***b* is forced to move upward by the height of the motor brake.

In the configuration in which the rotation drive force of the motor **40** is transmitted to the first arm **11** via the motor pulley **22***b*, the rotation shaft member pulley **22***a*, and the belt, the motor **40** may be provided in the lower part in the vertical direction and the first arm **11** may be provided in the upper part in the vertical direction with the belt in between (for example, in the configuration shown in FIGS. **1**A, **1**B, the first arm **11** is provided in the upper part of the reducer **50** and the motor **40** is provided in the rectangular part **20***b* of the base **20**). According to the configuration, the first arm **11** (reducer **50**) and the motor **40** are not aligned on the vertical line, and the space below the first arm **11** can be used as a space in which the other components than the motor **40** exist. Accordingly, the length of the cable routings **30** existing over the first arm **11** and the base **20** extending along the rotation axis Ax_1 can be made longer. As the length in which the cable routings **30** linearly extend is longer, aged deterioration when the cable routings **30** are twisted may be further suppressed and the lifetime of the cable routings **30** may be further elongated.

In the above described configuration, the reducer and the first arm **11** are provided in positions not immediately above the motor **40**. Therefore, even when a member smaller than the reducer **50** is provided above the motor **40**, the total height of the base **20** is unchanged. Further, the motor brake **42** smaller than the reducer **50** is easily formed, and thereby, as shown in FIGS. **3**A and **3**B, the base **20** including the motor brake **42** may be formed without increase in the size of the base **20** by the configuration including the motor brake **42** above the motor pulley **22***b* in the vertical direction. Note that, as the motor brake **42**, various configurations can be employed and brakes of known various systems can be configured.

Further, shortening of the lifetime of the cable routings may be prevented by managing the cable routings within the base **20**. For example, in the robot **10** including the drive parts (motor, pulley, rotation shaft member, etc.) existing inside of the base **20** for rotating the first arm **11**, the base **20** may include an opening part and a cover attachable to the opening part, the cover may include a cable routing connecting part for connecting the cable routings **30** existing inside of the base **20** to a connection destination outside of the base **20**, the cable routings **30** may include a pipe for flowing a fluid, the cable routing connecting part may include a joint to which the pipe is connected, and the drive parts may not exist in the extension destination of the joint in the cover attached to the opening part.

FIGS. **4**A and **4**B show the base **20** as seen from the rear. In the base **20** shown in the drawings, an opening part **24***a* is formed in the rear surface. Further, a cover **24***b* that covers the opening part **24***a* can be attached to the base **20**. A plurality of cable routing connecting parts **24***c* to **24***f* are attached to the cover **24***b*. The respective cable routing connecting parts **24***c* to **24***f* are attached to extend in the perpendicular direction to the flat surface of the cover **24***b*. Note that the cable routing connecting part **24***c* is a joint to which a pipe is connected, the cable routing connecting part **24***d* is a connector to which a power line is connected, and the cable routing connecting part **24***e* is a connector to which a communication line is connected. The cable routing connecting part **24***f* is a connector for a cable routing not used in the operation process of the robot **10**, a connector for a cable routing for which bending of the cable routing is not significantly problematic (cable routings separately existing, not bundled cable routings or the like), or the like.

The base **20** has the drive parts including the motor **40** etc. inside. The main section of the drive parts is covered by a plate or the like and, in FIG. **4**B, a boundary of the drive parts existing on the side of the cable routing connecting parts **24***c* to **24***d* is shown by a thick line BL. If the cable routings **30** come into contact with the drive parts, the cable routings **30** may be broken due to driving of the drive parts and the lifetime may be shorter. Or, in a state in which the cover **24***b* is attached to the opening part **24***a*, if the drive parts exist in the extension destination of the cable routing connecting parts (in the extension destination of the cable routings to the cable routing connecting parts in the connection direction), it is necessary to bend the cable routings **30** within the base **20** to avoid the drive parts.

Accordingly, in the embodiment, the drive parts are adapted not to exist in the extension destination of the cable routing connecting parts **24***c* to **24***e* (when the cable routing connecting parts **24***c* to **24***e* are projected on FIG. **4**B, the projected figures are on the left side of the thick line BL). On this account, the cable routings **30** connected to the cable routing connecting parts **24***c* to **24***e* are not largely bent for avoiding an interference with the drive parts inside of the base **20** or the like. Accordingly, it is possible to prevent shortening of the lifetime of the cable routings **30**. Note that it is difficult to sharply bend the pipe as the cable routings for securing the flow of the fluid within the pipe. Therefore, the effect is significant by the application of the configuration of the embodiment in which the drive parts do not exist in the extension destination of the cable routing connecting parts to the cable routing connecting part **24***c* connecting the pipe.

Note that the cable routing connecting parts for connecting the cable routings for which an interference with the drive parts is hard to be assumed may be attached to the cover **24***b* in a state in which the drive parts may exist in the extension destination. For example, the cable routing connecting part **24***f* shown in FIG. **4**A is a connector for a cable routing not used in the operation process of the robot **10**, a connector for a cable routing for which bending of the cable routing is not significantly problematic, or the like. That is, in the former case, even when the drive parts exist in the extension destination of the cable routing connecting parts, the cable routings do not interfere with the drive parts. Or, in the latter case, the degree of freedom of routing of the cable routings is higher and the cable routings may be routed to avoid the drive parts. Further, the cable routings connected to the component elements of the drive parts are not necessarily formed so that the drive parts may not exist in the extension destination of the cable routing connecting parts. For example, the cable routing connecting parts of the cable routings connecting to a connector **24***g* of the ground wire as shown in FIG. **4**B may be attached to the cover **24***b* so that the connector **24***g* and the drive parts may exist in the extension destination.

(5) Another Embodiment 2:

The above described embodiments can employ various configurations explained here. Further, the various configurations explained here may be applied to different configurations from those of the above described embodiments. Here, as an example of the various configurations, the case where the robot **10** can be suspended from a ceiling is explained. In the example, the suspension refers to installation of the robot **10** (base **20**) on a ceiling. In this case, when a lubricating oil for reducing wear of sliding parts including the flexspline **50***b*, the gear of the circular spline **50***c*, the bearing **50***d*, etc. within the reducer **50** of the base **20** is supplied from the first arm **11** side (if the first arm **11** is not connected to the base **20**, the side to which the first arm **11** is connected, and the same applies hereinafter) with respect to the sliding parts into the reducer **50**, the lubricating oil may accumulate on the first arm **11** side due to the gravity force and not sufficiently spread over the sliding parts.

To resolve the problem, the base **20** may include an oil supply port **100**, which will be described in FIG. **5**. FIG. **5** shows an example of the base **20** including the oil supply port **100**. The sectional view shown in FIG. **5** is a sectional view of the main body **20***a* of the base **20** of the suspended robot **10** cut in the right-to-left direction shown in FIG. **1**A.

Hereinafter, for convenience of explanation, a surface attached to an object as an installation location (e.g. a ceiling, a floor, or the like) of the robot **10** (base **20**) is referred to as "attachment surface **90**". In the example, the attachment surface **90** is a surface in the base **20** on the opposite side to the first arm **11** with respect to the reducer **50**. As shown in FIG. **5**, the robot **10** is suspended from the ceiling, and the up-and-down relationship between the reducer **50** and the attachment surface **90** is inverted to the up-and-down relationship between the reducer **50** and the attachment surface **90** shown in FIG. **2**A.

The base **20** shown in FIG. **5** includes the oil supply port **100** from which the lubricating oil can be supplied to the sliding parts from the opposite side to the first arm **11** (in the example, the attachment surface **90** side) with respect to the sliding parts inside of the reducer **50**. That is, when the robot **10** (base **20**) is suspended from the ceiling, the oil supply port **100** is located above the sliding parts as shown in FIG. **5**. Accordingly, the lubricating oil supplied from the oil supply port **100** flows from the opposite side to the first arm **11** sequentially through the sliding parts toward the first arm **11** side inside of the reducer **50**. Thereby, even when suspended from the ceiling, the robot **10** may reduce wear of the sliding parts by the lubricating oil supplied from the opposite side to the first arm **11** with respect to the sliding parts.

As described above, from the oil supply port **100**, the lubricating oil may be sufficiently spread over the sliding parts when the robot **10** is suspended from the ceiling, however, it may be impossible that the lubricating oil is sufficiently spread over the sliding parts when the robot **10** is placed on the floor. This is because, when the robot **10** is placed on the floor, the lubricating oil supplied from the oil supply port **100** accumulates on the opposite side to the first arm **11** (in the example, the attachment surface **90** side) inside of the reducer **50** due to the gravity force. Note that, in the example, the floor placement refers to installation of the robot **10** (the attachment surface **90** of the base **20**) on the floor.

Accordingly, the base **20** of the robot **10** may include an oil supply port **110** shown in FIG. **6** in addition to the oil supply port **100** shown in FIG. **5**. FIG. **6** shows an example of the base **20** including the oil supply port **110**. The sectional view shown in FIG. **6** is a sectional view of the main body **20***a* of the base **20** of the robot **10** placed on the floor cut in a section different from the section shown in FIG. **5**. As shown in FIG. **6**, the robot **10** is placed on the floor, and the up-and-down relationship between the reducer **50** and the attachment surface **90** is inverted to the up-and-down relationship between the reducer **50** and the attachment surface **90** shown in FIG. **5**.

In the example, as shown in FIG. **6**, the base **20** includes the oil supply port **110** from which the lubricating oil can be supplied to the sliding parts from the first arm **11** side with respect to the sliding parts inside of the reducer **50** in addition to the oil supply port **100** shown in FIG. **5**. That is, when the robot **10** is placed on the floor, the oil supply port **110** is located above the sliding parts as shown in FIG. **6**. Accordingly, the lubricating oil supplied from the oil supply port **110** flows from the first arm **11** side sequentially through the sliding parts toward the opposite side to the first arm **11** (in the example, the attachment surface **90** side) with respect to the sliding parts inside of the reducer **50**. Thereby, even when placed on the floor, the robot **10** may reduce wear of the sliding parts by the lubricating oil supplied from the first arm **11** side with respect to the sliding parts. Note that the section of the base **20** shown in FIG. **6** is different from the section of the base **20** shown in FIG. **5**, and the oil supply port **100** is hidden in FIG. **6**.

Further, in the case where the base **20** includes both the oil supply port **100** and the oil supply port **110**, the robot **10** may reduce wear of the sliding parts in both being suspended from the ceiling and placed on the floor. As a result, in the case where the user installs the robot **10** on either the ceiling or the floor according to the work desired to be performed by the robot **10**, the lubricating oil may be sufficiently spread over the sliding parts. That is, the robot **10** has higher versatility.

In the base **20** according to the embodiment, as an example, the oil supply port **100** is provided in a position on the opposite side to the side on which the arm is provided with respect to the sliding parts in the gravity direction. Accordingly, in an installation environment in which the arm is provided in the lower part with respect to the sliding parts in the gravity direction, the lubricating oil may be supplied from the oil supply port **100** located in the upper part with respect to the sliding parts in the gravity direction, and thereby, the lubricating oil may be easily spread over the sliding parts. In this case, for example, the attachment surface **90** of the base **20** on the opposite side to the arm is installed on the ceiling and the robot **10** is brought into the suspended environment.

Further, in the base **20** according to the embodiment, as an example, the oil supply port **110** is provided on the side on which the arm is provided with respect to the sliding parts in the gravity direction. Accordingly, in an installation environment in which the arm is provided in the upper part with respect to the sliding parts in the gravity direction, the lubricating oil may be supplied from the oil supply port **110** located in the upper part with respect to the sliding parts in the gravity direction, and thereby, the lubricating oil may be easily spread over the sliding parts. In this case, for example, the attachment surface **90** of the base **20** on the opposite side to the arm is installed on the floor and the robot **10** is brought into the floor installation environment.

(6) Another Embodiment 3:

The above described embodiments can employ various configurations explained here. Further, the various configurations explained here may be applied to different configurations from those of the above described embodiments. Here, as an example of the various configurations, the case where the robot **10** can be suspended from the ceiling is explained. In this case, for example, when rain leakage or water leakage due to burst of a water pipe or the like occurs in the ceiling on which the base **20** is installed, water may enter the base **20**. Or, for example, when a fluid such as water is shot toward the ceiling on which the robot **10** is installed, the fluid may enter the base **20** from between the base **20** and the ceiling due to some failure (trouble or the like).

When a fluid such as water enters the base **20**, between the base **20** and the ceiling, or the like, a failure of a short electronic or electric circuit or the like may be caused. To suppress the failure, the base **20** of the robot **10** may include a first groove **200** and a second groove **210** shown in FIGS. **7**A and **7**B. FIG. **7**A is a perspective view of an example of an interior of the main body **20***a* of the base **20** as seen from the attachment surface **90** side. Note that, regarding the base **20** shown in FIG. **7**A, the rear side shown in FIG. **1**A faces the front side of the paper surface.

As shown in FIG. **7**A, in the example, a circular hole part H connecting to the inside of the base **20** is provided on in the attachment surface **90**. Further, a stepped surface **91** lower from the attachment surface **90** toward the inside of the base **20** is provided on the edge of the hole part H. The outer circumference of the stepped surface **91** is inner than the attachment surface **90** and outer than the edge of the hole part H.

The stepped surface **91** is a surface to which a lid **220** for preventing entrance of a fluid such as water into the base **20** is attached. Note that, in the lid **220**, wires and pipes extending from the inside of the base **20**, substrates for connecting wires and pipes extending from another apparatus, etc. may be provided. Further, in the stepped surface **91**, the first groove **200** is provided outside of the edge of the hole part H along the edge of the hole part H. The first groove **200** is a groove for providing a sealing member **300** that prevents entrance of a fluid such as water into the base **20** from between the stepped surface **91** and the lid **220**. The sealing member **300** is e.g. a fluorine resin or the like. Note that the sealing member **300** may be formed using another material instead.

Further, in the attachment surface **90**, the second groove **210** is provided outside of the outer circumference of the stepped surface **91** along the outer circumference of the stepped surface **91**. The second groove **210** is a groove for providing a sealing member **310** that prevents entrance of a fluid such as water into the lid **220** side from between the attachment surface **90** and an object on which the base **20** is installed. The sealing member **310** is e.g. a fluorine resin or the like. Note that the sealing member **310** may be formed using another material instead.

FIG. **7**B shows both a top view of the base **20** shown in FIG. **7**A from the upside shown in FIG. **1**A and an enlarged view of a range W surrounded by a solid line of the top view. As shown in the enlarged view of the range W, the first groove **200** is provided in the stepped surface **91** along the edge of the hole part H. Further, the second groove **210** is provided in the attachment surface **90** along the outer circumference of the stepped surface **91**.

FIG. **8** shows an example of the base **20** installed on a ceiling OH. Further, the sectional view shown in FIG. **8** is a sectional view of the base **20** cut in the front-to-back direction shown in FIG. **1**A. In FIG. **8**, in the base **20**, the lid **220** is attached to the stepped surface **91** and the hole part H is blocked. In the state, the sealing member **300** provided in the first groove **200** blocks to prevent a fluid such as water from entering between the stepped surface **91** and the first groove **200**. Thereby, the robot **10** may suppress a failure caused by entrance of the fluid into the base **20**. Further, the sealing member **310** provided in the second groove **210** blocks to prevent a fluid such as water from entering between the attachment surface **90** and the ceiling OH. Thereby, the robot **10** may suppress a failure caused by entrance of the fluid between the attachment surface **90** of the base **20** and the object to which the base **20** is attached.

In the base **20** according to the embodiment, as an example, the first groove **200** for preventing entrance of the fluid into the base **20** is provided. For example, the first groove **200** is formed in the stepped surface **91** provided on the attachment surface **90** side. Further, for example, the sealing member **300** is fitted in the first groove **200** and the sealing member **300** is pressed by the lid **220**. Here, the first groove **200** and the sealing member **300** are provided over the entire of the circumference of the stepped surface **91** of the base **20**. Thereby, the flow of the fluid may be prevented by the sealing member **300** and entrance of the fluid from outside into the base **20** may be prevented.

Further, in the base **20** according to the embodiment, as an example, the second groove **210** for preventing the flow of the fluid between the base **20** and an object on which the base **20** is installed (e.g. a floor, the ceiling OH, a wall, or the like) is provided. For example, the second groove **210** is formed in the attachment surface **90**. Further, for example, the sealing member **310** is fitted in the second groove **210** and the sealing member **310** is pressed by the object. Here, the second groove **210** and the sealing member **310** are provided over the entire of the circumference of the attachment surface **90** of the base **20**. Thereby, the flow of the fluid may be prevented by the sealing member **310** and the flow of the fluid between the base **20** and the object may be prevented.

Furthermore, in the embodiment, the second groove **210** is provided outside of the first groove **200**.

Note that, in the embodiment, prevention of the entrance of a liquid as a fluid is explained as an example, however, both prevention of the entrance of the liquid and prevention of entrance of a gas may be realized. As another example, a configuration that can prevent at least entrance of a gas as a fluid may be used.

As described above, the robot **10** in the embodiment can supply the lubricating oil to the sliding parts from the opposite side (in the example, the attachment surface **90** side) to the arm (in the example, the first arm **11**) with respect to the sliding parts. Thereby, the robot **10** may reduce wear of the sliding parts by the lubricating oil supplied from the opposite side to the arm with respect to the sliding parts.

Further, the robot **10** can supply the lubricating oil to the sliding parts from the arm side with respect to the sliding parts. Thereby, the robot **10** may reduce wear of the sliding parts by the lubricating oil supplied from the arm side with respect to the sliding parts.

The robot **10** can be suspended from the ceiling. Thereby, the robot **10** can operate in the state where the robot is suspended from the ceiling.

Further, the robot **10** can be placed on the floor. Thereby, the robot **10** can operate in the floor placement state.

The robot **10** prevents entrance of a fluid into the base **20** by the first groove **200** and prevents entrance of a fluid between an object (in the example, a ceiling, a floor, a wall, or the like) and the base **20** by the second groove **210**. Thereby, the robot **10** may suppress failures caused by entrance of the fluid into the base **20** and between the object and the base **20**.

As above, the embodiments of the invention are described in detail with reference to the drawings, and the specific configurations are not limited to the embodiments and changes, replacements, deletions, etc. may be made without departing of the scope of the invention.

The entire disclosure of Japanese Patent Application No. 2015-148045, filed Jul. 27, 2015 is expressly incorporated by reference herein.

What is claimed is:

1. A robot comprising:

a base;

an arm provided on the base;

a rotation shaft member that is hollow-tubular shaped, the rotation shaft member being provided in the base and the arm so as to continuously extend from the base to the arm, the rotation shaft member having a rotation axis around which the arm rotates;

a cable routing member being configured with a plurality of cables, the cable routing member extending through an inner space of an entirety of the rotation shaft member, the cable routing member being bundled at first and second bundle positions on the rotation axis, the first bundle position being located in the base, the second bundle position being located in the arm, the cable routing member being bundled by a plate member and a bundling tool that is fastened to the plate member at the first bundle position; and

a reducer having a sliding part, the reducer decelerating driving of the arm,

wherein a lubricating oil is configured to be supplied to the sliding part from a location opposite to the arm with respect to the sliding part, and

the cable routing member linearly extends between the first bundle position and the second bundle position.

2. The robot according to claim **1**, wherein the lubricating oil is configured to be supplied to the sliding part from a side of the arm with respect to the sliding part.

3. The robot according to claim **2**, adapted to be suspended from a ceiling.

4. The robot according to claim **3**, adapted to be placed on a floor.

5. The robot according to claim **2**, adapted to be placed on a floor.

6. The robot according to claim **2**, wherein the base includes:

a first groove for preventing entrance of a fluid into the base; and

a second groove for preventing entrance of a fluid between an object on which the base is installed and the base.

7. The robot according to claim **1**, adapted to be suspended from a ceiling.

8. The robot according to claim **7**, adapted to be placed on a floor.

9. The robot according to claim **1**, adapted to be placed on a floor.

10. The robot according to claim **1**, wherein the base includes:

a first groove for preventing entrance of a fluid into the base; and

a second groove for preventing entrance of a fluid between an object on which the base is installed and the base.

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